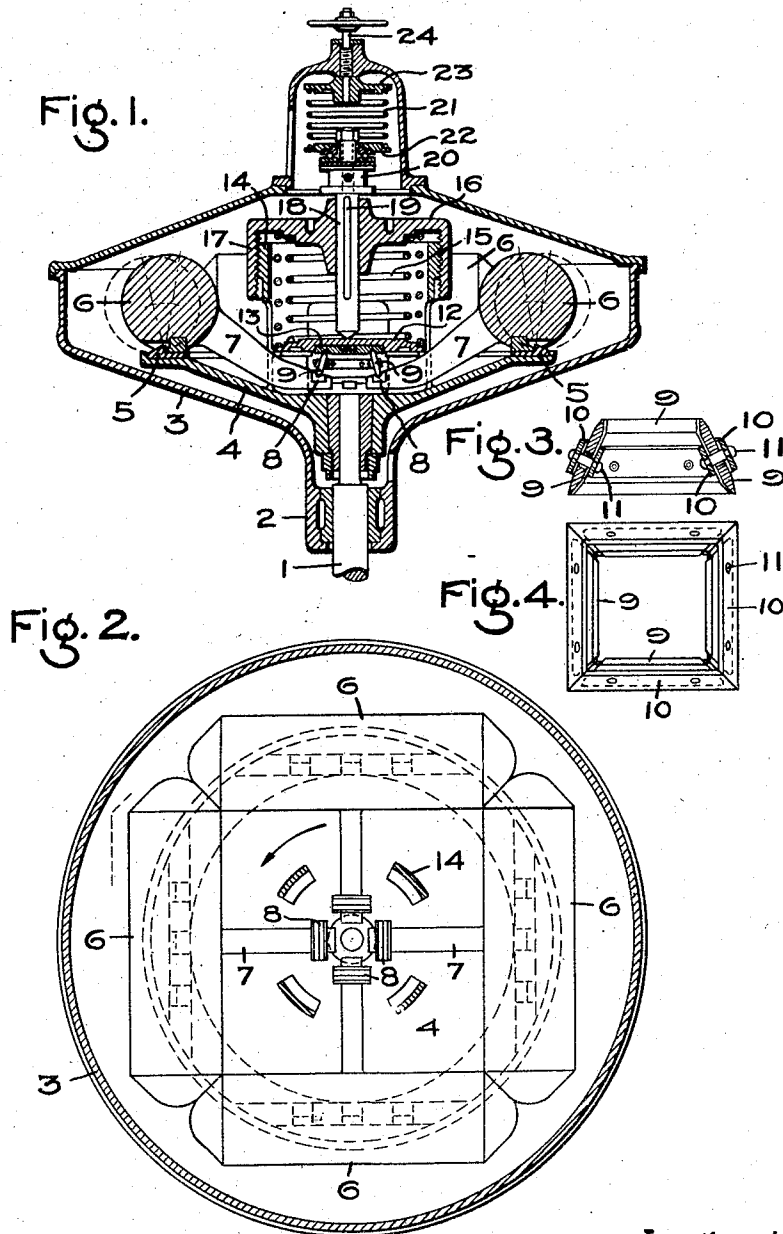


B. KRÄMER.
CENTRIFUGAL GOVERNOR.
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Witnesses:

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL GOVERNOR.

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To all whom it may concern:

Be it known that I, BERNHARD KRÄMER, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Centrifugal Governors, of which the following is a specification.

This invention relates to governing or regulating apparatus in which centrifugally operated weights effect a movement of a regulating valve or other equivalent element, in accordance with changes in the speed of rotation of the machine to be governed.

The object of the invention is to prevent as far as possible any friction between the valve-operating rod and the part of the governor which actuates it; and also to so arrange the knife edges which transmit the movement of the weights to the spring supporting plate, that they will automatically and mutually support each other, avoid sticking, and properly center the plate, thereby obviating friction losses to a great extent.

The several features of novelty are hereinafter set forth in detail and particularly pointed out in the appended claims, reference being had to the accompanying drawing, in which—

Figure 1 is a vertical longitudinal section on an axial plane, of a centrifugal governor embodying my improvements; Fig. 2 is a sectional plan view showing the weights; Fig. 3 is a cross section of the knife edges on a larger scale; and Fig. 4 is a top plan view of the same.

The upright shaft 1 revolves in a bearing 2, preferably in the lower end of a stationary casing 3 which houses the working parts. Fixed to the top of the shaft is a circular frame 4 carrying a plurality of fulcrum plates 5 on each of which is pivotally supported a weight 6; in the present instance a cylindrical body, resting on its side. An arm 7 extends laterally from each weight, and all the arms converge toward the shaft. At the inner end of each arm is a cross piece 8, preferably grooved to receive a knife edge, which is a blade 9 of steel or the like having parallel upper and lower edges sharpened as shown in Fig. 3. The blades are grouped symmetrically

around the axis of the shaft, in planes at right angles to their respective arms 7. In the drawing the arms are depressed so that the upper edges of the blades lie in the same horizontal plane as the fulcrum of the weights. This causes the blades to be tipped inwardly at the top so that together they form a polygonal figure like the frustum of a pyramid, and the adjoining ends of the blades are, therefore chamfered off, as shown in Fig. 4. The blades do not quite touch each other, but have a slight longitudinal play. They are preferably retained in their approximate positions by one or more bands 10 carrying rivets 11 which pass loosely through holes of somewhat larger diameter in said blades.

Supported on the upper knife edges is a follower 12, preferably having an inserted steel plate 13 to bear upon said knife edges. The follower 12 is circular and is free to rise and fall in a cage 14 rising from the frame 4. A helical spring 15 rests upon said follower, its upper end abutting against a cap 16 having a screw-threaded flange 17 engaging with external screw-threads on the cage. This cap affords a means for adjusting the tension of said spring.

A rod 18 slides freely through a central hole in the cap, in alignment with the shaft 1. It is preferably provided with a spline 19 to cause it to rotate with the other moving parts of the governor. This rod has a collar 20 or some equivalent means for imparting its movements to the valve or other regulating mechanism. Above the rod and in line therewith is a light coiled spring 21, which rests at its lower end upon a plate 22 supported on a bearing on the rod, preferably a ball bearing, as shown. At its upper end the spring abuts against a plate 23 adjustable by means of a screw-threaded stem 24 tapped through the top of the casing 3.

The lower end of the rod 18 is stepped on the follower at its center. Inasmuch as said follower tends to rotate to and fro more or less in the cage 14 with the flexing of the spring 15, there is liable to be a friction loss at the point where the rod rests upon the follower. In order to reduce this to a minimum, the end of the rod is reduced, being

made conical or spherical so as to bear upon the follower at a single minute point only, in the axial line of the shaft and follower.

In consequence of the arrangements above described, where any displacement of the knife edges occurs, caused by centrifugal force, they will be supported one against the other after a small longitudinal displacement, so that at all times a positive operation thereof is afforded without any possibility of sticking. Centering by means of the oblique position of the knife edges gives to the entire knife edge arrangement an extremely stable character. Their mutual connection has further the advantage of facilitating the mounting of the governor to an important degree, since the knife edges are placed on their supporting cross-pieces as a whole.

The slight friction between the rod 18 and the follower prevents any angular movement being imparted from the follower to the rod so that the latter, notwithstanding the rotary movements of the spring and follower, can move up and down in its position practically without any friction loss.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a centrifugal governor having a plurality of movable weights and a movable element, a plurality of knife edge blades loosely interposed between the weights and said element, and means connecting said knife edge blades so that they mutually support each other.

2. In a centrifugal governor having a plurality of movable weights and a movable rod, a plurality of knife edge blades loosely interposed between said weights and said rod and grouped symmetrically around the axis of said rod, and means connecting the blades of the group together.

3. In a centrifugal governor having a plurality of movable weights and a movable element, a plurality of knife edge blades loosely interposed between the weights and said element, the blades being grouped symmetrically around the axis of the governor in the form of a substantially closed polygon and adapted to mutually restrain each other with respect to longitudinal movement.

4. In a centrifugal governor having a plurality of movable weights and a mov-

able element, a plurality of knife edge blades loosely interposed between the weights and said element, said knife edge blades mutually supporting each other, and a band loosely attached to said blades.

5. In a centrifugal governor, the combination with a plurality of movable weights, of a spring-pressed follower, a rod actuated thereby, and a plurality of knife edge blades grouped in a substantially closed polygon and inclined toward each other, said blades being interposed between the weights and said follower.

6. In a centrifugal governor, the combination with a rotating frame and a plurality of movable weights carried thereby, of a spring resisting the movement of the weights, a follower interposed between one end of the spring and the weights and free to rotate with the flexing of the spring, an axially arranged rod mounted on the frame for transmitting the movements of the follower, and a splined connection between the rod and the frame, one end of said rod having pivotal contact with the follower.

7. In a centrifugal governor, the combination of a rotating frame, a plurality of movable weights mounted on the frame, a spring that opposes the movement of the weights, a follower which is rotatably mounted on the frame and engages one end of the spring, knife edge connections between the weights and the follower including a seat for the knife edges that is rotatably mounted on the follower, an axially arranged rod for transmitting the motion of the follower, and a splined connection between the rod and the frame, said rod having one end in pivotal contact with the follower.

8. A centrifugal governor having a plurality of movable weights, a movable member, means for transmitting motion between the weights and the member including a plurality of knife-edged devices, and means connecting said devices together that permits the devices and the connecting means to move relative to each other.

9. A centrifugal governor having a plurality of movable weights, a movable member, means for transmitting motion between the weights and the member including a plurality of blades or plates provided with knife edges, a band, and pins carried by the band, there being holes for the pins in said blades that are larger than the pins in a direction transverse to the knife edges.

10. A centrifugal governor having a plurality of movable weights, a movable member, means for transmitting motion between the weights and the member including a plurality of blades or plates provided with knife edges and arranged about the axis of the governor in the form of a substantially closed polygon, bands ar-

5 ranged around the inside and outside of the blades, said bands being inclined to the axis of the governor, and pins extending between the bands and securing them together, there being holes for the pins in the blades that afford a clearance to permit the blades to move relative to the bands.

10 11. In a centrifugal governor, the combination of a rotating frame having a centrally arranged cylindrical cage, a plurality of movable weights mounted on the frame outside of the cage, a follower rotatably and slidably mounted in one end of the cage, an adjustable cap on the other end of the cage, a spring arranged between the follower and the cap, an axially arranged rod that has one end in pivotal contact with the follower and the other end projecting outward through the cap, a splined connection between the rod and the cap, and means connecting the weights and the follower.

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Witnesses:

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OSCAR UBERTH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."